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(54) Sub-soiling apparatus

(57) Sub-soiling apparatus comprises cast metal bodies forming a shoe (14) and a shin (12) mounted on a depending leg (10). The shin comprises a bottom end portion (22) in the form of a collar through which a foot (16) of the leg extends, and behind the collar the shin is provided with a deep groove (24) accommodating a leading edge of the leg. The shoe fits over a toe-end portion (20) of the foot, and the shoe and the shin are together retained on the leg by means of a single roll pin (26) driven through aligned holes in the shoe and the foot. The shoe and the collar of the shin are both shaped internally to have complementary rectangular cross-sections to those of the foot, so to prevent rotation about the foot.

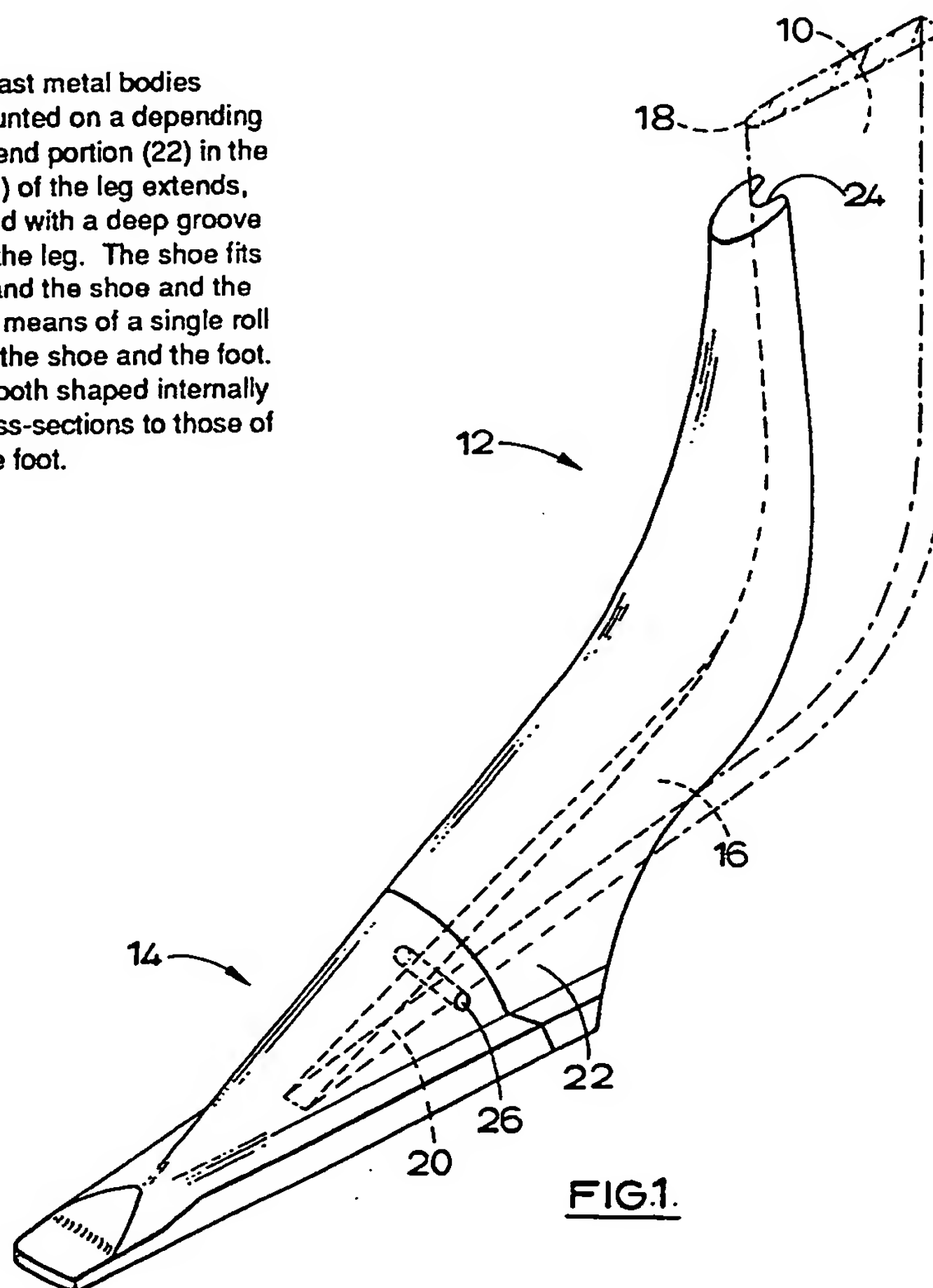


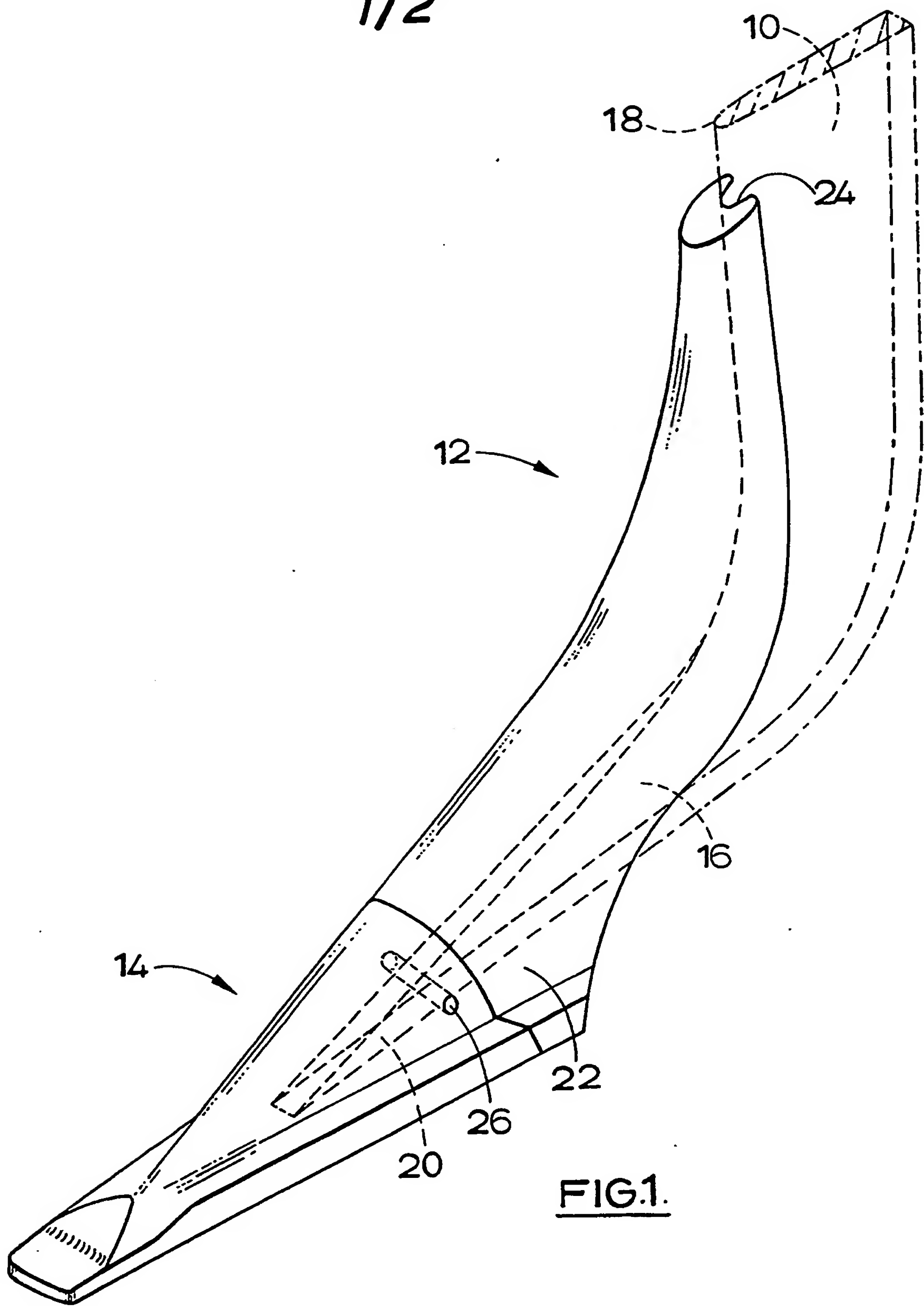
FIG.1.

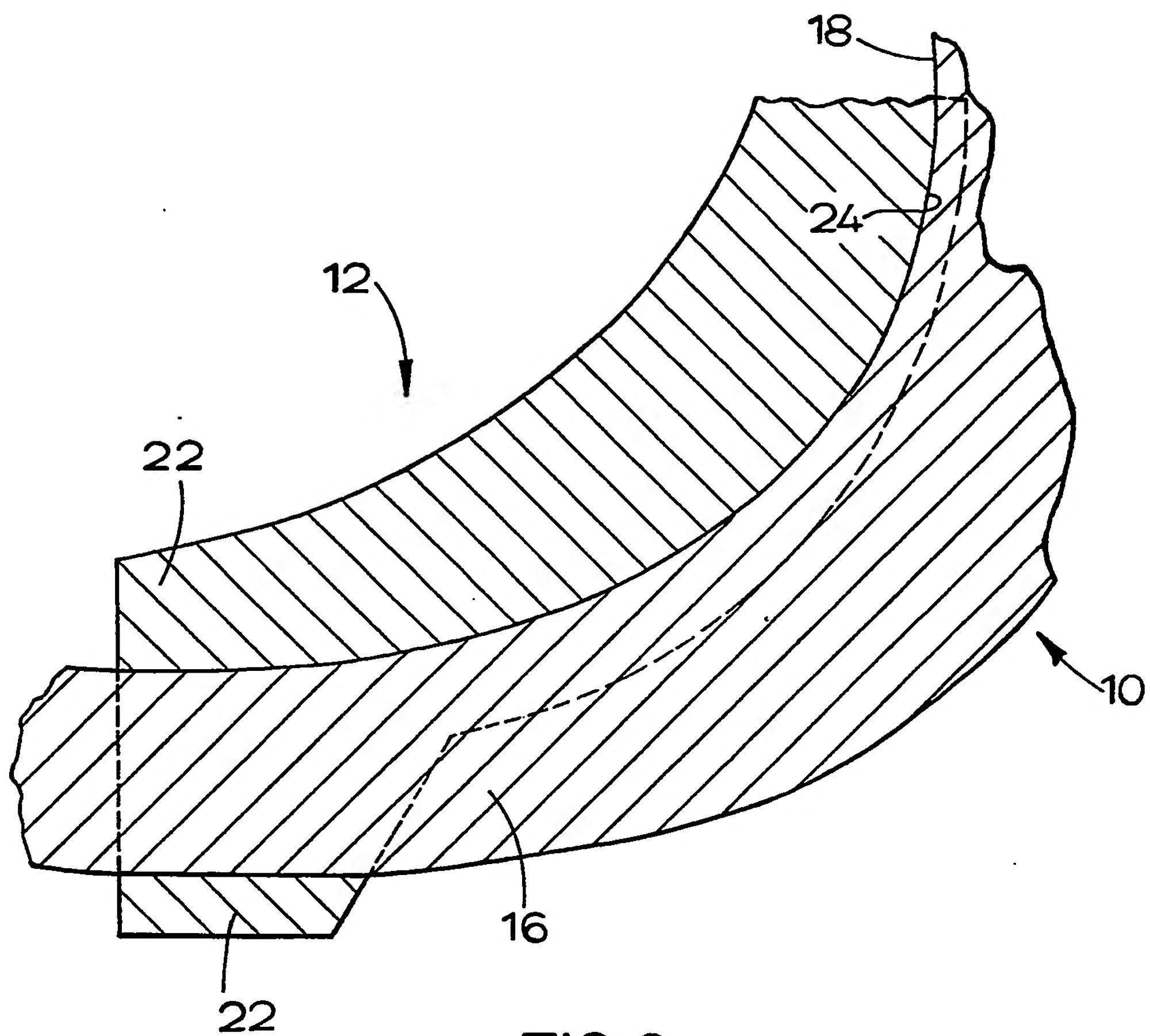
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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FIG.1.

FIG. 2.

SUB-SOILING APPARATUS

Sub-soiling is a ground-working operation undertaken by farmers, usually after harvesting, to improve aeration and drainage of crop-growing land; it may be effected annually, and can be found to improve crop yields quite significantly through improvement of the ground condition.

In sub-soiling, an implement is drawn through the earth, working to a depth of perhaps 600mm (about 2 feet) primarily for the bottom end of the implement to disturb the ground beneath the top soil. The implement is usually formed as a slim leg which depends from supporting structure drawn, in use, by a tractor. A bottom end portion of the leg provides what can be termed a foot which is generally pointed and which projects forwardly (i.e. in the direction in which the leg is to be moved through the ground). Above the foot, at least for that portion of the leg which will move through the ground, the leg is usually in the form of a thick blade arranged edge-on to the direction of intended movement and having a generally rounded leading edge.

Such a sub-soiling leg is usually made in one piece. However if used like that it would wear away very quickly, especially at the foot and immediately above the foot, and the whole leg would have to be replaced. Accordingly it is usual for at least a toe end portion of the foot to be protected by a cap which can be termed a shoe; if a shoe is to be fitted, the foot of the sub-soiling leg can be of any suitable form to support the shoe securely, and the shoe shaped suitably for working the ground. Commonly such a shoe is made simply to be slipped over the foot, having a

suitably formed deep slot or recess to accommodate the foot, but to prevent loss it is usually necessary to weld the shoe in place on the leg.

5 If sub-soiling legs are used with shoes but without further protection, serious wear can still occur immediately behind and above the shoe. For this reason it is usual to protect the leg in that region by means of a protector which can be termed a shin. A
10 common form of shin is similar in form to a piece of angle iron laid over the leading edge and reaching down approximately to the shoe. The shin may be secured to the leg by means of suitable strap and bolt fastenings.

15 The known arrangements of shoes and shins are not very satisfactory in various respects, but particularly as regards wear and maintenance. As has been referred to above, to avoid the shoes falling off they are commonly welded to the leg, but this means that
20 substantial workshop time is required for replacement; since the wear rate with known shoes is rapid, the time that the equipment has to spend out of use in the workshop for repair can have a major effect on costs and efficiency. The known shins wear quickly, are
25 clumsy and can be awkward to fit, and are sometimes found not to have protected the leg fully.

It is an object of the present invention to provide improved sub-soiling apparatus.

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The invention provides, in one of its aspects, sub-soiling apparatus comprising a leg and leg-protecting means comprising shin and shoe portions, the protecting means being shaped to become interengaged with the leg
35 when mounted on the leg and being arranged to be retained mounted by means of releasable fastening means.

In a preferred construction a bottom end portion of the shin is in the form of a collar, arranged partially or wholly to embrace the foot behind the shoe, the collar having a passage through it of a generally complementary cross-section to the foot which prevents rotation of the shin about the foot. Behind the collar, the shin may be grooved centrally in an undersurface to accommodate a leading edge portion of the leg, the shin so being wrapped about the edge, giving protection to the edge and also assisting lateral security of the mounting of the shin on the leg.

The releasable fastening means, which serves to prevent the shin and the shoe slipping off the leg after mounting, most preferably comprises a single fastening which may be in the form of a securing pin (e.g. a roll pin) arranged to be driven through aligned holes in the shoe (or the shin) and the foot; most simply it can be the shoe which is arranged to be secured, the shin then being retained by abutment against the shoe, but alternatively the shoe could be in some way coupled to the shin and the shin secured.

It is preferred to form the shin and the shoe as cast bodies of a suitably tough wear-resistant metal. The two bodies are preferably shaped to present substantially continuous outer upper surfaces where they abut when mounted; this can be important in reducing drag in use of the implement.

The invention provides, in another of its aspects, sub-soiling apparatus comprising a leg, a shin and a shoe, the shin and the shoe being shaped bodies formed to present substantially continuous outer upper surfaces where they abut when mounted on the leg.

The invention provides, in yet another of its aspects, sub-soiling apparatus comprising a leg, a shin and a shoe, the shin and the shoe together being arranged to be secured on the leg by means of a single releasable fastening.

The invention provides, in yet another of its aspects, sub-soiling apparatus comprising a leg, a shin, and a shoe, the shin being a unitary body arranged to be secured on the leg by interlocking engagement with the leg upon being mounted and retained in its mounted position by the shoe when the shoe is secured.

There now follows a detailed description, to be read with reference to the accompanying drawings, of sub-soiling apparatus which illustrates the invention by way of example.

In the accompanying drawings:

Figure 1 is a perspective view of a shoe and a shin of the apparatus in assembled arrangement, the outline of a leg on which they would be so mounted being indicated in broken line; and

Figure 2 is a view in cross-section through the shin when mounted on the leg.

Sub-soiling apparatus comprises a leg 10, a shin 12 and a shoe 14. The leg 10 is of steel and depends in use from supporting structure (not shown). It comprises at its bottom end a projecting portion providing a foot 16. As indicated in Figure 1, the leg is generally slim, being in the form of a thick blade having a rounded leading edge 18, the blade being

edge-on to the intended direction of travel through the soil. At its foot the leg tapers and is generally pointed, being in the form of a wedge of rectangular cross-section for most of its length. The foot projects forwardly (i.e. in the intended direction of travel).

The shin 12 and the shoe 14 are unitary cast bodies of tough wear-resistant metal. The shoe 14 is deeply recessed to receive snugly a toe-end portion 20 of the foot 16, being arranged to be fitted on to the foot in the manner of a cap. The shin 12 (which has to be mounted first) is arranged to be mounted on the leg immediately adjacent to (i.e. behind) the shoe, a bottom end portion 22 (see also Figure 2) of the shin being in the form of a collar through which the foot extends and which abuts the shoe 14; the shoe and the shin are carefully shaped to minimise drag in use, and present substantially continuous outer upper surfaces where they abut when mounted on the leg, as illustrated by Figure 1. Behind the collar 22 the shin extends as a shield over the remainder of the foot and up the leg, extending sufficiently far up the leg to protect that part of the leg subject to wear in use. An undersurface of the shin is formed centrally with a deep groove 24 to accommodate a leading edge portion of the leg. The shin is so wrapped about the leading edge portion, which both protects the leg and serves to give lateral security to the mounting of the shin on the leg.

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The shin 12 is mounted on the leg by slipping the collar 22 over the foot 16 until the leading edge portion of the leg becomes engaged in the groove 24. The toe-end portion 20 of the foot passes right through the collar 22. The shoe 14 is then slipped on to the toe-end portion of the foot to abut the shin and retain

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the shin in its mounted position on the leg. Releasable fastening means of the apparatus, for securing the shoe and the shin in position, comprises a roll pin 26 which is driven through aligned holes in the shoe 14 and the foot 16.

The shin 12 is so secured on the leg solely by its interlocking engagement with the leg (i.e. at the collar 22 and groove 24) and its retention against slipping off by the pinned shoe 14. The passage through the collar 22 is of a generally complementary cross-section to that portion of the foot which it embraces, preventing rotation of the shin about the foot.

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When it becomes necessary to replace either the shoe or the shin because of wear, this can be done very simply by driving out the securing pin 26 and slipping the shoe (and if required the shin) off the leg over the foot. This use of a simple single releasable fastening enables rapid replacements to be effected, even in the field.

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CLAIMS

1. Sub-sciling apparatus comprising a leg and leg-protecting means comprising shin and shoe portions, the protecting means being shaped to become securely non-rotatably interengaged with the leg when mounted on the leg and being arranged to be retained mounted by means of releasable fastening means.
2. Apparatus according to claim 1 comprising separable shin and shoe members, a bottom end portion of the shin being in the form of a collar, arranged partially or wholly to embrace the foot of the leg behind the shoe, the collar having a passage through it of a generally complementary cross-section to the foot which prevents rotation of the shin about the foot.
3. Apparatus according to claim 2 in which behind the collar the shin is grooved centrally in an undersurface to accommodate a leading edge portion of the leg, the shin so being wrapped about the edge to give protection to the edge and to assist with lateral security of the mounting of the shin on the leg.
4. Apparatus according to any one of claims 1, 2 and 3 in which the releasable fastening means consists of a single fastening device.
5. Apparatus according to claim 4 in which the fastening device comprises a securing pin arranged to be driven through aligned holes in the protecting means and the foot.
6. Apparatus according to any one of claims 1 to 5 in which the protecting means is cast of a suitably tough wear-resistant metal.

7. Sub-soiling apparatus comprising a leg, a shin and a shoe, the shin and the shoe being shaped bodies formed to present substantially continuous outer upper surfaces where they abut when mounted on the leg.

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8. Apparatus according to claim 7 in which the shin and the shoe are formed as cast bodies of a suitably tough wear-resistant metal.

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9. Sub-soiling apparatus comprising a leg, a shin and a shoe, the shin and the shoe together being arranged to be secured on the leg by means of a single releasable fastening device.

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10. Apparatus according to claim 9 in which the fastening device comprises a securing pin arranged to be driven through the leg through aligned holes in the shoe and/or the shin.

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11. Sub-soiling apparatus comprising a leg, a shin, and a shoe, the shin being a unitary body arranged to be secured on the leg by interlocking engagement with the leg upon being mounted and retained in its mounted position by the shoe when the shoe is secured.

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12. Sub-soiling apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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13. A shin suitable for use in conjunction with a shoe in apparatus according to any one of claims 1 to 12, the shin being cast of a suitably tough wear-resistant metal and comprising a bottom end portion in the form of a collar arranged partially or wholly to embrace the foot of the leg behind the shoe.

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14. A shin substantially as hereinbefore described with reference to the accompanying drawings.

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